

# Inmarsat Update

ICAO IPACG FIT/33

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14-20 October 2020

# Agenda

## Update on Classic Aero

- Current status
- Network improvements
- Cybersecurity

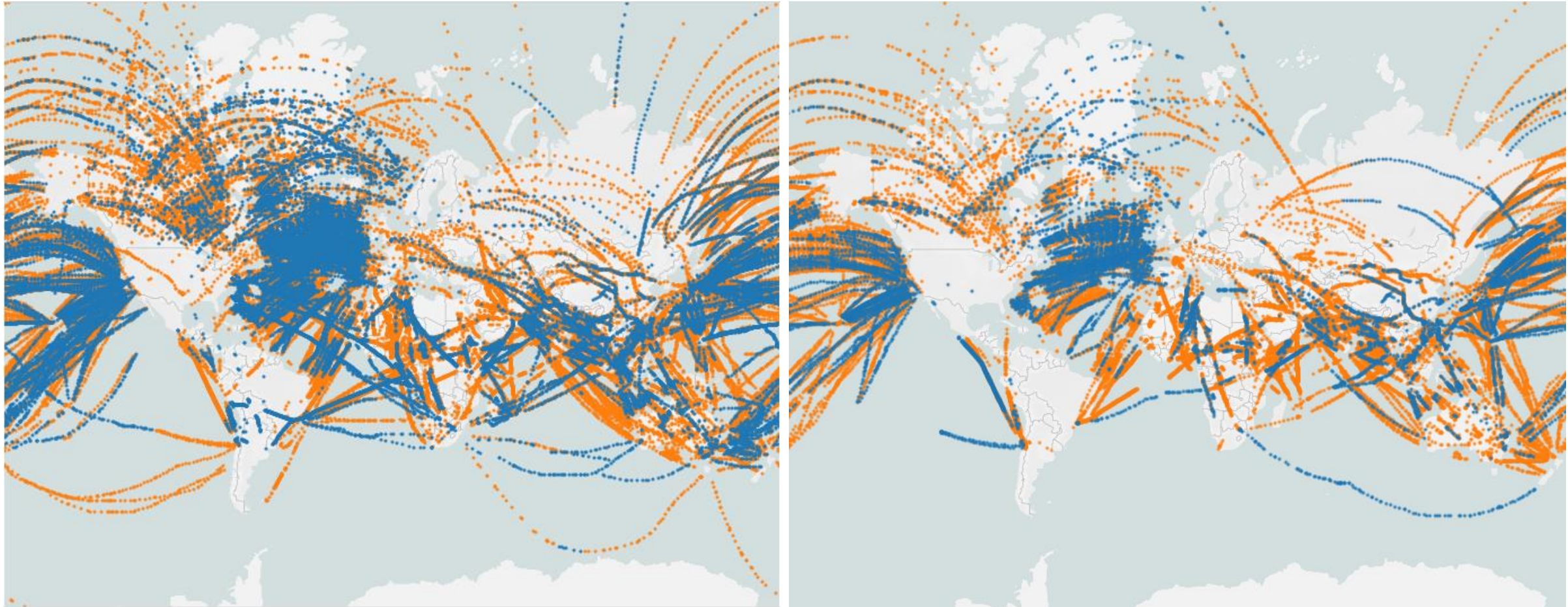
## Update on SB Safety and IRIS

- SB-S 1.0 Service
  - Current status
  - Terminal availability
  - China AGGW
  - Message timing analysis
- SB-S 2.0 Service development and terminals
- IRIS

# Classic Aero ADS-C over 1 day: 16 Sep '19 compared with 10 Sep '20

Blue indicates avionics still using I3 satellite identifiers in Owner Requirements Tables (ORT)

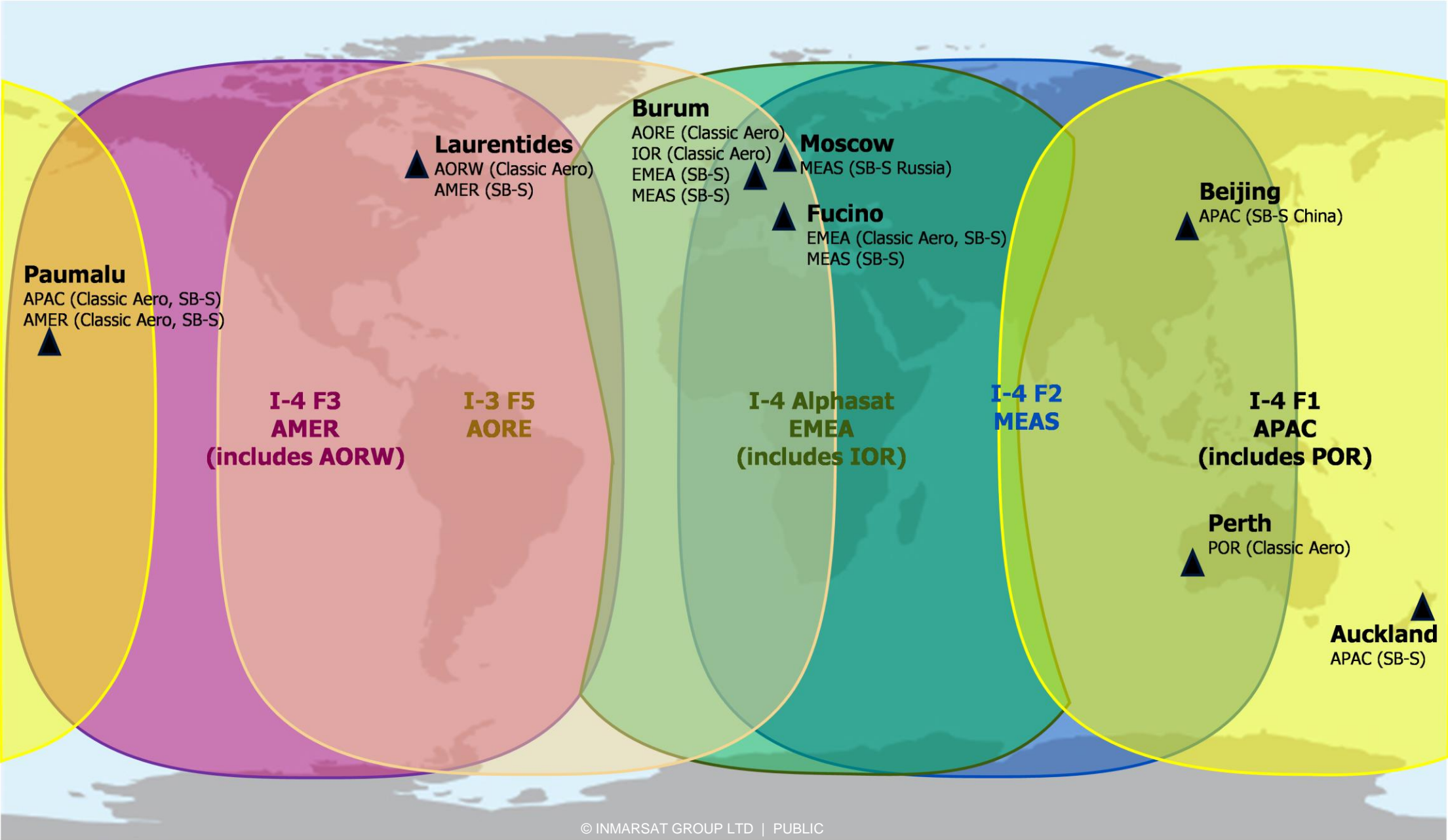
Orange indicates those using I4 identifiers



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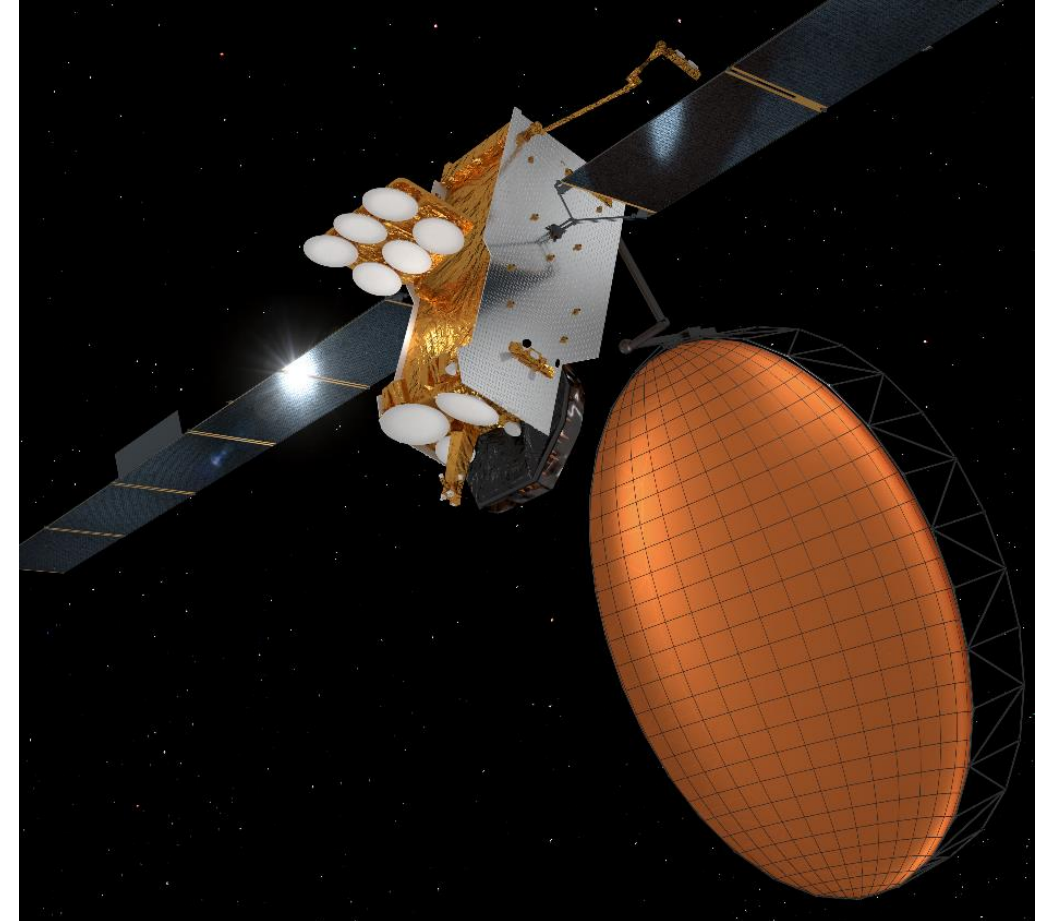


# Inmarsat Operational Coverage Map (Classic Aero and SB-Safety)



# I-6 Constellation

- Two I-6 satellites are being constructed by Airbus Defence and Space. Both are currently scheduled for launch in 2021
  - Based on Airbus' Eurostar platform in its E3000e variant, which exclusively uses electric propulsion for orbit raising
  - Designed to remain in service for a minimum of 15 years
  - Features Ka-band payloads hosted on L-band satellites
- The Inmarsat-6 satellites confirm our commitment to L-band services, and will support a new generation of capabilities for global safety services



# Classic Aero GES Software and Hardware Upgrades

- Due to essential maintenance at Paumalu, the dormant half of the Perth GES was modified to carry APAC traffic as of 17 June
- Enhanced the Radio Frequency System (RFS) at Fucino — Completed
- GES software upgrade for new T-channel enhanced management software, for the mitigation of certain mis-bursting terminals (operating from 19<sup>th</sup> February)
- Updates to support SATVOICE VoIP Service — Completed
- Refresh of GES hardware with upgrade to software 9.2.0, including cybersecurity enhancements:
  - Virtualising the system on powerful new servers
  - Includes Paumalu and Fucino, Burum and Perth GESs, completed 10 Sep 2020
- After almost 14 years of Interoperability with the Inmarsat Classic Aero System, the JCAB MTSAT service was closed on the 6<sup>th</sup> February 2020



# Cybersecurity

- Inmarsat is continually reviewing its internal infrastructure and services to ensure that we understand the latest risks and threats
- We are applying this across the Inmarsat enterprise, including to both the Classic Aero and SB-Safety infrastructure
- Inmarsat is evolving its services to include additional security controls that are appropriate for the type of risk and technology being used
- Inmarsat is ISO 27000 certified, ensuring we have a complete information security management system in place



The image shows two individuals from behind, looking at a large wall of digital displays. The displays feature various data visualizations including line graphs, bar charts, pie charts, and maps. Some displays show numerical values like '36,225,095,129' and '1,388'. The overall theme is cybersecurity monitoring and data analysis.

## Cybersecurity Operations Centre

- 24/7/365 Monitoring
- Highly skilled security experts
- Threat Intelligence
- Immediate response
- Investigations & Forensics
- Proactive and reactive



# Cybersecurity

- Inmarsat's cybersecurity infrastructure, following the ISO 27000 framework, includes ensuring that:
  - Inmarsat's life-cycle and configuration management processes are complete
  - We have processes in place to address:
    - Security hardening for data interfaces,
    - Operating system improvement (for cyber protection/patches),
    - Process controls (such as whitelisting),
    - Malware and AV detection and prevention software, and
    - Cybersecurity reporting mechanisms
- Through the ISMS processes and life-cycle management, we will continue to:
  - Evaluate and improve our processes to ensure they are effective
  - Continually test our security controls to ensure they are effective at meeting the evolving threat landscape

# SB-S 1.0 Service Status

- An FAA PARC (Performance-based Aviation Rulemaking Committee) service performance evaluation was conducted on SB-S 1.0, involving over two years of in-service operation, during which the FANS/ACARS message latency and service availability was analysed and reported, demonstrating that the system met the required Performance-Based Communications and Surveillance (PBCS) requirements
- Following this, SB-S 1.0 entered commercial operations on 17th April 2018
- The Inmarsat Distribution Partners Collins, SITA and CTTIC are providing SB-S 1.0 services to a number of passenger and bizjet aircraft
- Over 100 SB-S 1.0 aircraft are now in commercial service

# SB-S 1.0 ADS-C Data from 1 Sept 2017 to 13 Sept 2020

Ocean Region (No.)

- (4F1) APAC (5)
- (4F3) AMER (7)
- (AF1) EMEA (6)

(4F1) APAC (5)	(4F3) AMER (7)	(AF1) EMEA (6)	Grand Total
19,367	601,326	47,237	667,930



# SB-S 1.0 Terminals

- SB-S 1.0 **Aviator 300D** terminals are available from Cobham now for Class 7 and Class 6 antennas
- Supports all the SB-S services, providing a single channel of voice to the cockpit
- Voice service access is via a voice call dialler unit

**COBHAM**



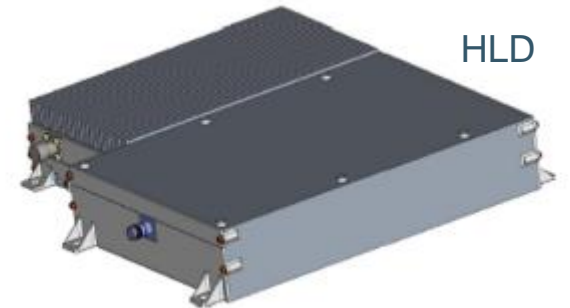
- Avionica is developing a lightweight, cost-effective terminal for the retrofit market
- **satLINK SBS** expected to be available 2021
  - ACARS over SB-S IP support,
  - IP-broadband connectivity support for EFB
- Class 7 and Class 6 broadband IP services support

 **avionica**

SDU



HLD

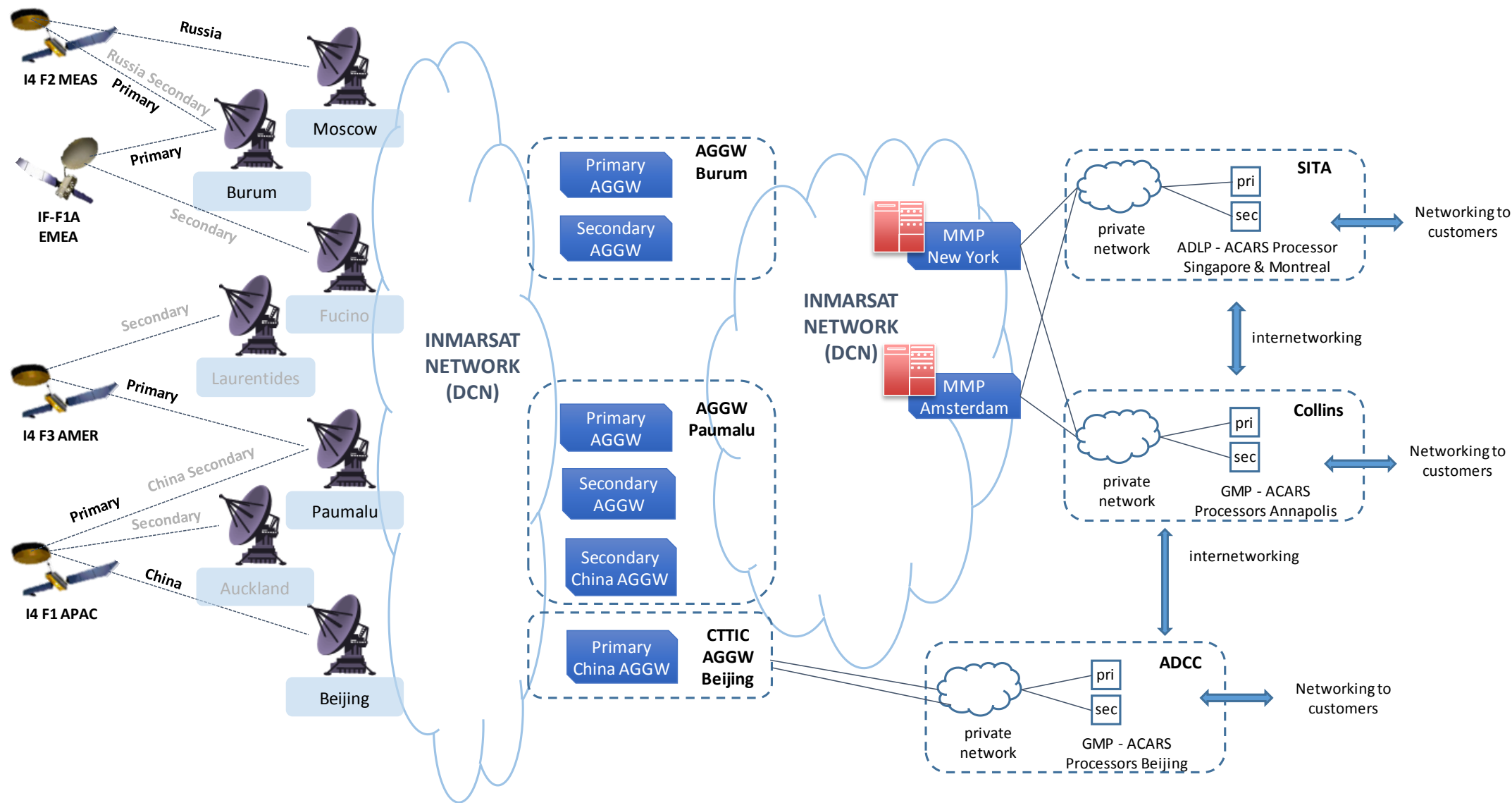




# China SB-S 1.0 ACARS Ground Gateway (AGGW)

- New SB-Safety dual ACARS Gateway installed at Beijing SAS, with additional backup dual gateway installed at Paumalu, with CTTIC as CSP
- AGGW integration and test complete:
  - All ISAT Data Comms Network (DCN) infrastructure components integrated and tested
  - First Chinese SB-Safety test terminal sent and received ACARS messages through the CTTIC AGGW gateway to the ADCC Global Message Processor – Aug '19
  - Alpha evaluation with first aircraft underway – Sep '20
- Planning Beta evaluation
- Project completion expected Q4 2020

# High Availability Design



# Initial CPDLC latency up & downlink KPI analytics

## CPDLC Statistics

CPDLC Thresholds (s)
----------------------

		RCMP [4]-[1]	RCTPCSP [5]-[1] + [4]-[3]	Ground to air	PORT [3]-[5]	Downlink response
TT 95.0%	RCP240	180	100	60	60	60
	RCP130	60	10	5	44	5
ET 99.9%	RCP240	210	120	60	60	60
	RCP130	120	18	9	100	9

TT 95%
--------

RCP	ocean region (no)	Count of CPDLC	ACP [4]-[1] within RCP	ACTP (([5]-[1]) + ([4]-[3]) within RCTP)	CPDLC Ground to Air latency [5]-[1] within RCP	PORT GPS [3]-[5] within RCP	Downlink response time [4]-[3] within RCP
RCP240	4F1 APAC (5)	64	100.00%	100.00%	100.00%	96.88%	100.00%
	4F3 AMER (7)	21,235	99.92%	99.98%	100.00%	99.11%	99.94%
	AF1 EMEA (6)	1,801	99.89%	100.00%	100.00%	98.83%	100.00%

ET 99.9%
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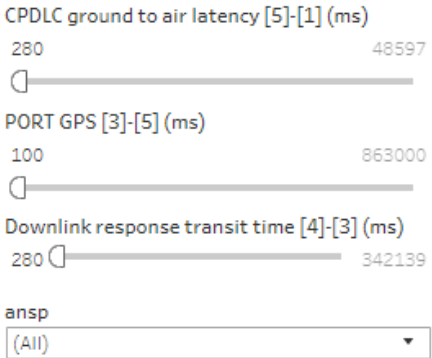
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	AF1 EMEA (6)	1,801	99.94%	100.00%	100.00%	98.83%	100.00%

Click on bars to filter on time. Deselect and use -+ at the bottom left to switch granularity of filter (D/W/M/Q/Y)



x<95%  
x>=95

x<99%  
99%<=x<99.9%  
x>=99.9%



DP Owner  
☒ (All)  
☒ ARINC [3034]  
☒ SITA [5009]

## Conditions:

- Example analysis of 2019 data
- Cobham Aviator 300D (HGA) & 350D (IGA)
- FANS/ACARS messages
- 3 Ocean Regions
- Only uplink transactions that have an associated downlink (i.e involving pilot response) have been analysed
- CPDLC data cleansed for unrealistic delivery times; any delay less than the minimum Gateway-Satellite-Aircraft delay, has been removed

*Note: This is an early example of the analytics capability – threshold values and results still undergoing validation.*

# Evolution to add SB-S 2.0

- Inmarsat has now evolved its SB-Safety portfolio to include SB-Safety 2.0 to meet the enhanced security requirements of aircraft manufacturers and regulatory requirements
  - With SB-S 2.0, the Packet Switched (PS) services in the Aircraft Control Domain (ACD), i.e. ACARS, PS voice, and position reporting, are additionally protected through the implementation of an air-to-ground Virtual Private Network (VPN) tunnel that is mutually authenticated between the aircraft satellite terminal and the Inmarsat ground infrastructure utilising an Inmarsat (PKI) solution
- SB-S ACARS Ground Gateways may now be configured in two ways:
  - As an AGGW gateway, as part of the SB-S 1.0 service, supporting SB-S 1.0 terminals
  - As a GDGW gateway, as part of the SB-S 2.0 service, supporting SB-S 2.0 terminals such as the Cobham Aviator S and Honeywell Aspire 400, providing PKI VPN tunnel authentication between the terminal and the GDGW
- Additional security controls are being applied to the SB-S 1.0 and SB-S 2.0 gateways
  - COTS VPN is established between SB-S 2.0 GDGWs and CSP networks
- SB-S 2.0 service expected to become available end 2020 (subject to confirmation)



# Cobham SB-S 2.0 Terminals



The Cobham Aviator S series of terminals support the enhanced security VPN for ACARS and PS voice and are being made available line-fit on Airbus and Boeing aircraft

- **Aviator 200S**
  - 2 MCU terminal operating with Enhanced Low Gain Antenna (Class 4), or HELGA
  - Single SwiftBroadband RF channel
- **Aviator 700S**
  - 2 MCU terminal with 2 MCU HPA and DLNA, operating with High Gain Antenna (Class 6)
  - Dual SwiftBroadband RF channels

# Honeywell SB-S 2.0 Terminals



The Honeywell Aspire 400 series of terminals also support the enhanced security VPN for ACARS and PS voice and are being made available line-fit on Boeing aircraft

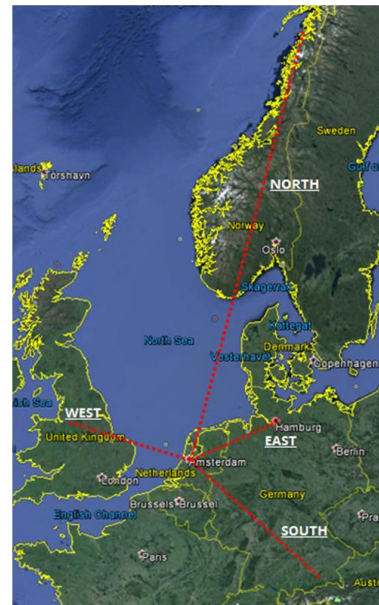
- **Aspire 400**
  - 2 MCU terminal operating with Enhanced Low Gain Antenna (Class 4), or HELGA
    - Single SwiftBroadband RF channel
  - 2 x 2MCU terminal operating with Intermediate Gain Antenna (Class 7)
    - Dual SwiftBroadband RF channels
  - 2 x 2MCU terminal operating with High Gain Antenna (Class 6)
    - Dual SwiftBroadband RF channels

# Retrofit & Linefit SB-S



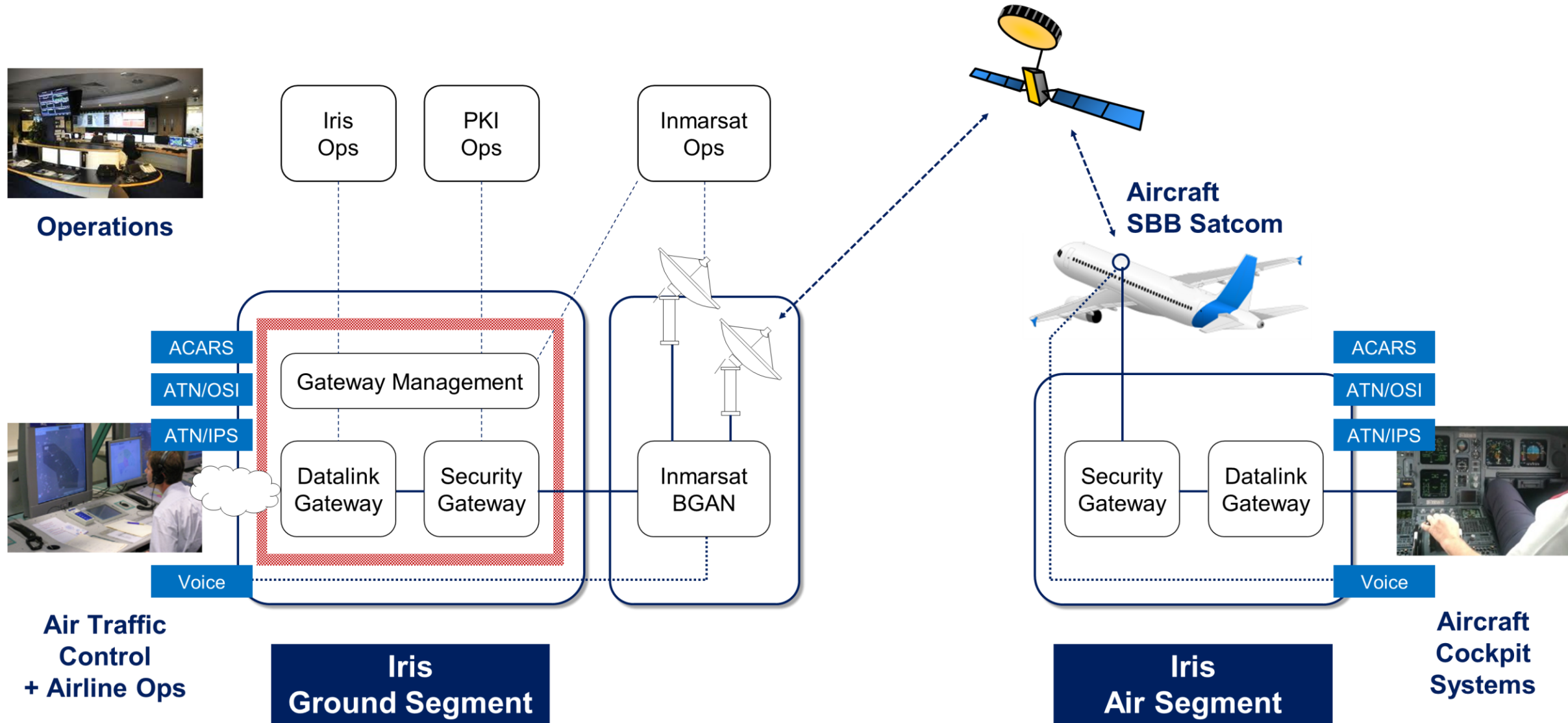
# Iris

- Inmarsat is leading the ESA Iris partnership to enable satellite based ATM in dense continental airspace
- Iris will support ATN B1 / B2 services in multilink with VDL
- Flight trials on Airbus and NLR test aircraft validated prototype implementations
- The service is designed to support the same ATS applications and meeting the performance for VDLm2 (WG-78/SC-214)
- The ground infrastructure is now deployed at Burum and Paumalu. Avionics vendors are implementing the multilink management. Arrangements are being made to equip up to 20 narrow-bodied aircraft for an initial operational service.
- Initially focused on Europe (ATN/OSI), the global infrastructure will enable the service to be supported elsewhere.
- An early implementation of ATN/IPS capability is also planned.





# Iris/SB-S 2.0 Architecture with VPN Authentication



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# Thank You

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